Kangaroo monitoring in relation to kangaroo management in New South Wales

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ABSTRACT

Annual commercial cull quotas for kangaroos are based on population estimates derived for each of the 11 kangaroo management zones in New South Wales. The kangaroo population estimates are principally obtained through direct monitoring of these species by aerial surveys using helicopters and fixed-wing aircraft. Where mountainous or heavily wooded areas prevent aerial surveys, walked line transects are conducted. Experimental aerial surveys, conducted over three years from winter of 1998, aim to develop a new set of regional habitat correction factors to be applied to the results obtained from fixed-wing aerial surveys. The currently used 200 m wide survey strip will be compared to a new 100 m wide survey strip as a part of this work. Since it is anticipated that this research will improve the fixed-wing aerial survey method, its outcomes will be adopted in the New South Wales aerial survey programme.

INTRODUCTION

Kangaroos are managed in New South Wales by the NSW National Parks and Wildlife Service through the NSW Kangaroo Management Program in accordance with the *National Parks and Wildlife Act 1974*. A key part of this programme is the culling of kangaroos undertaken mainly on a commercial basis through the kangaroo industry. This operation occurs across approximately 600 000 km^2 of the western two-thirds of New South Wales.

The Management Program requires annual population estimates for each species culled commercially, namely the red kangaroo *Macropus rufus*, eastern grey kangaroo *M. giganteus*, western grey kangaroo *M. fuliginosus*, the common or eastern wallaroo *M. robustus robustus* and euro or inland wallaroo *M. robustus erubescens*. These population estimates are obtained principally from the direct monitoring of the populations of these species in western New South Wales. The annual commercial quotas for each species are set in relation to the population estimate.

THE KANGAROO MANAGEMENT PROGRAM

There are 11 kangaroo management zones in New South Wales. They are considered as independent management units within the whole commercial zone. Each management zone has a separate population estimate for each species in relation to the commercial quotas set. A district office of the Service issues commercial Trapper licences and tags.

The principal method used to produce the kangaroo population estimates is aerial survey with a fixed-wing aircraft. However, because of the variability in the terrain across the zones comprising part of the New England tablelands and western slopes in the east of the commercial zone, and part of the western plains and the Barrier Ranges in the west of the commercial zone, other methods are also used to monitor the kangaroo populations.

Western plains

From 1978 through until 1984, aerial surveys were conducted on seven randomly selected monitor blocks, each represented by a 1:250 000 map sheet. Kangaroo numbers for the whole of the western plains were extrapolated from the results of the monitor blocks (J. Caughley *et al.* 1984). From 1984 onwards this survey programme was replaced with one comprising two transects surveyed along the 15' and 45' parallels of each one-degree of latitude of the whole of the western plains. The standard strip transect method outlined in Caughley *et al.* (1977) and Caughley and Grigg (1981) is employed for this survey. Over four weeks each winter, a high wing aircraft is flown at a height of 76 m and a speed of 185 km h^{-1} along the designated transect latitudes. Two observers, one on either side of the aircraft, survey a 200 m wide strip on the ground for kangaroos, recording the numbers seen after 97 sec. (a distance of 5 km) during a 7 sec. break. The habitat correction factors that were developed by Caughley *et al.* (1976) have been used in determining the population estimates of red kangaroos and grey kangaroos (eastern and western grey combined) (Fig. 1).

From the results of this survey, red, eastern grey and western grey kangaroo densities and population sizes are estimated for each one-degree square block of the survey area. These density estimates are then used to determine the kangaroo population size in each management zone. To do this, the

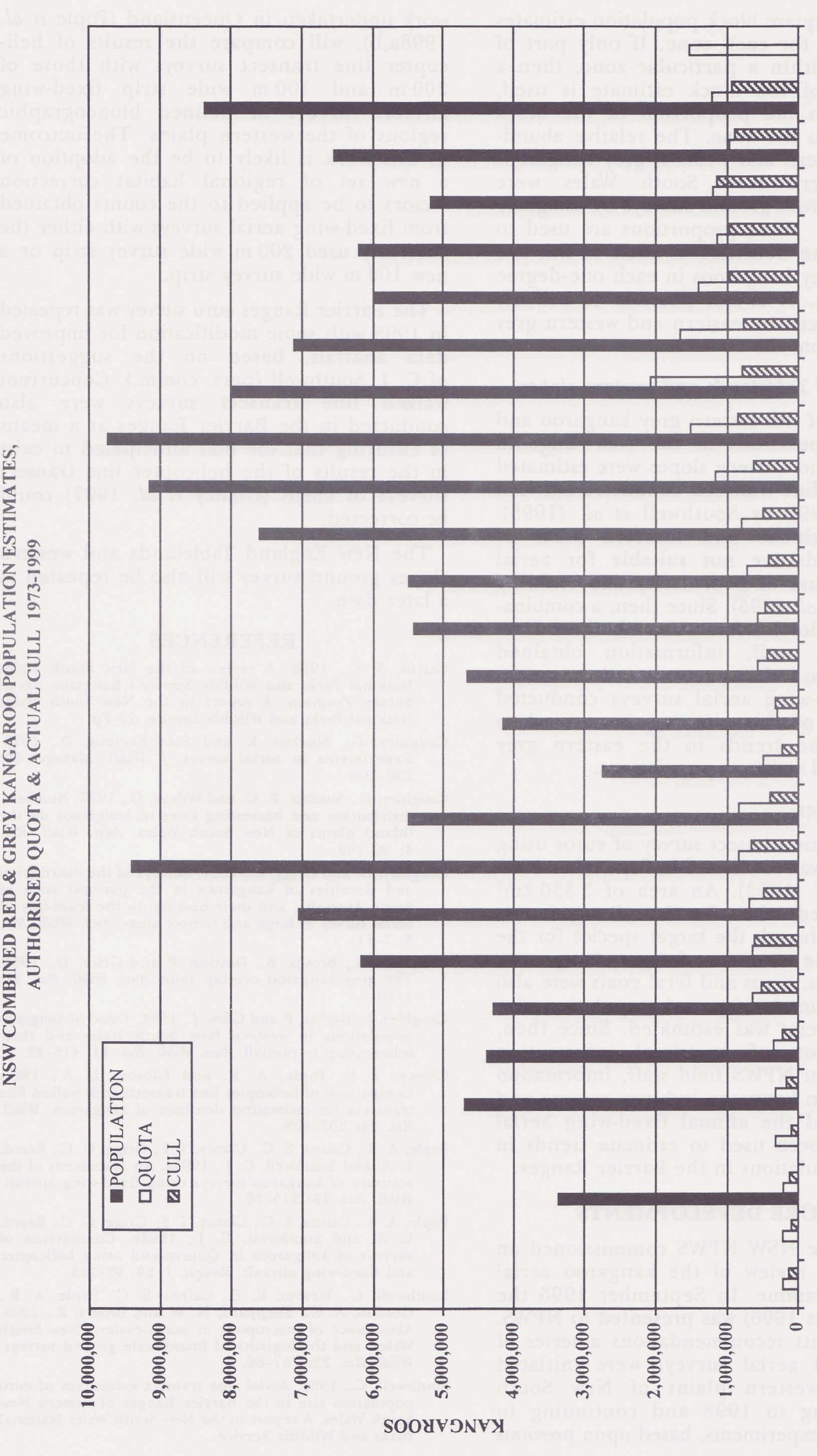

Figure 1. Red and grey (western and eastern) kangaroo, combined population estimates authorized quota and actual cull.

one-degree square block population estimates are summed for each zone. If only part of a block is within a particular zone, then a proportion of the block estimate is used, equivalent to the proportion of the block that falls into the zone. The relative abundances of eastern and western grey kangaroos across western New South Wales were determined from ground surveys by Caughley *et al.* (1984). These proportions are used to determine the densities of each of the two species of grey kangaroos in each one-degree square block. It is not possible to reliably distinguish between eastern and western grey kangaroos from the air.

New England Tablelands and western slopes

The sizes of the eastern grey kangaroo and wallaroo populations in the New England Tablelands and western slopes were estimated from walked line transects conducted between 1987 and 1992 by Southwell *et al.* (1995). The mountainous and forested areas of the tablelands are not suitable for aerial surveys because of poor safety and visibility (Southwell *et al.* 1995). Since then, a combination of anecdotal information obtained from NPWS field staff, information obtained from kangaroo industry returns and the results of the fixed-wing aerial surveys conducted to the west of this area has been used to determine the trends in the eastern grey kangaroo and wallaroo populations.

Barrier Ranges

An aerial line transect survey of euros using a helicopter was conducted in September 1993 by Southwell (1993). An area of 3 350 km² that included the Barrier Ranges was surveyed. Although the target species for the survey was the euro, data for grey kangaroos, red kangaroos, emus and feral goats were also recorded. The density and population size for each species was estimated. Since then, a combination of anecdotal information obtained from NPWS field staff, information obtained from kangaroo industry returns and the results of the annual fixed-wing aerial surveys has been used to estimate trends in the euro populations in the Barrier Ranges.

FUTURE DEVELOPMENTS

In 1996 the NSW NPWS commissioned an independent review of the kangaroo aerial survey programme. In September 1996 the report (Cairns 1996) was presented to NPWS. Based upon its recommendations a series of experimental aerial surveys were initiated across the western plains of New South Wales starting in 1998 and continuing to 2000. These experiments, based upon previous work undertaken in Queensland (Pople *et al.* 1998a,b), will compare the results of helicopter line transect surveys with those of 200 m and 100 m wide strip fixed-wing aircraft surveys in defined biogeographic regions of the western plains. The outcome of this work is likely to be the adoption of a new set of regional habitat correction factors to be applied to the counts obtained from fixed-wing aerial surveys with either the currently used 200 m wide survey strip or a new 100 m wide survey strip.

The Barrier Ranges euro survey was repeated in 1998 with some modification for improved data analysis, based on the suggestions of C. J. Southwell (pers. comm.). Concurrent walked line transect surveys were also conducted in the Barrier Ranges as a means of ensuring that the bias anticipated to exist in the results of the helicopter line transect surveys of euros (Clancy *et al.* 1997) could be corrected.

The New England Tablelands and western slopes ground survey will also be repeated at a later date.

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